PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION.

Improvements in or relating to Metal Coated Materials.

We, LEONARD WALTER CUTLER, a British Subject, of 59, Totteridge Road, Enfield, Middlesex; CARL ADOLPHE KLEIN, a British Subject, of 7, Queen Annes Grove, Bush Hill Park, Enfield, Middlesex, and ASSOCIATED LEAD MANUFACTURERS LIMITED, a British Company, of London House, 3, New London Street, London, E.C. 3, do hereby declare the nature of this invention to be as follows:—

This invention is for improvements in or relating to metal coated materials.

It is one object of the invention to provide a waterproof and airproof metal coated sheet material to serve as a substitute for metal foil and metal sheet.

It is well known to coat paper with metal foils by interposing an adhesive material between the metal foil and the paper. It is also known to apply metal powders to paper by means of a water soluble adhesive.

According to the present invention a process for coating surfaces with metals consists in first applying a layer of a water insoluble adhesive material to the surface and while the adhesive is in a liquid or viscous state distributing a soft metal in powder form over the surface, and after the adhesive has set burnishing or rolling the metal whereby the particles are flattened out to form a substantially continuous surface.

According to the invention a further metal may be deposited on the burnished surface by any of the well known processes for the deposition of metals.

In one form of the invention the surface to be coated is a sheet cellulosic material, for example, paper.

According to the invention powdered lead may be caused to adhere to a surface and thereafter be burnished thereon.

A suitable adhesive for the metal powder according to the invention is a solution comprising bitumen and a natural or synthetic resin in a volatile solvent.

The invention includes a waterproof metallized sheet material comprising a flexible backing sheet, for example, paper, a waterproof adhesive (for example, bitumen, with or without a resinous ingredient thereon), and a powdered soft metal, (for example, lead), coating secured to the backing sheet on one or both sides by the adhesive and burnished with or without another metal coating deposited upon the first.

The invention also includes a waterproof metallized sheet material wherein the adhesive permeates the body of the backing sheet and renders it waterproof in order that the sheet may be exposed to moisture or immersed in water.

The following is an example of one method of carrying out the invention though it will be understood that the invention is not in any way limited to the materials and conditions given:—

EXAMPLE.

Sheets of paper are impregnated with a bitumen-resin solution prepared by fusing the bitumen with resin and dissolving the product in naphtha. The adhesive after evaporation of the naphtha is viscous while hot and hardens completely on cooling. Finely divided lead powder is now rubbed on to the hot paper and the paper is allowed to cool. When cold it will be found that the powder adheres firmly to the paper. The paper holding the powder may be rolled if desired and may be then burnished by brushing or with burnishing stones or wheels, when it will be found that the material assumes the form which is almost identical with sheet metal or metal foil.

The sheet material can be soldered by the employment of suitable alloys, that is to say, alloys, the melting point of which is not sufficiently elevated to damage the paper or other backing when melted on to the sheet.

Dated this 14th day of December, 1928.

BOULT, WADE & TENNANT,
111 & 112, Hatton Garden, London, E.C. 1.
Chartered Patent Agents.

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Price 4s 6d

COMPLETE SPECIFICATION.

Improvements in or relating to Metal Coated Materials.

We, LEONARD WALTER CUTLER, a British Subject, of 59, Totteridge Road, Enfield, Middlesex, CARL ADOLPHE KLEIN, a British Subject, of 7, Queen Annes Grove, Bush Hill Park, Enfield, Middlesex, and ASSOCIATED LEAD MANUFACTURERS LIMITED, a British Company, of London House, 3, New London Street, London, E.C. 3, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to the metallising of surfaces, that is to say, to the coating of surfaces with metals. The invention is more particularly concerned with the metallising of paper and with the production thereby of waterproof and/or airproof metal-coated sheet-material to serve as a substitute for metal-foil and metal-sheet.

It is known to metallise paper by coating it with metal-foil applied to the paper by means of an adhesive material interposed between the metal-foil and the paper. It is also known to metallise paper by applying metal powders to paper by means of a water-soluble adhesive.

It has also been proposed to manufacture roofing material by impregnating a fibrous material, such as roofing felt, with a bituminous composition, coating one or both sides of the impregnated material with a wearing surface of harder bituminous composition, and, before this wearing surface has fully hardened, applying to it a coating of finely flaked metallic particles, said particles being applied to the surface either by being sprinkled on to it or by the bituminised roofing felt being traversed through a receptacle containing a supply of the metal particles.

It has further been proposed to metallise paper by applying thereto a binder film of bitumen and depositing upon the bitumen film a coating of powdered metal.

It has been proposed also to manufacture metallised moulded cement objects by strewing metal powder on to the surface of a mass of cement to be moulded to form the object, introducing the metal-strewed mass of cement into the mould and subjecting the contents of the mould to high pressure whereby the moulding operation is effected and at the same time the layer of metal particles on the surface of the cement is consolidated into a water-proof coating upon the moulded object.

According to the present invention, a method of metallising a surface comprises applying thereto a film of an adhesive, depositing upon said film a coating of metal powder, rubbing said powder on to the adhesive film whilst the latter is in a slightly tenacious condition and thereby finely distributing it over said film and firmly attaching it thereto, and subjecting the resulting metal-coated surface to pressure so as to flatten out the metal particles thereon and produce thereby a continuous metal film upon the surface.

The metal applied to the surface must, of course, be one which is sufficiently soft to enable its particles to be flattened out on the surface with the formation, as stated, of a continuous metal film.

The invention further includes, as applied to the metallising of a porous material, e.g. porous sheet material, a method of metallising which comprises applying an adhesive to the material so as to impregnate the latter and form upon its surface to be metallised a thin film of adhesive, depositing upon said film a coating of metal powder, rubbing said powder on to the adhesive film whilst the latter is in a slightly tenacious condition and thereby finely distributing it over the film and firmly attaching it thereto, and subjecting the resulting metal-coated surface to pressure so as to flatten out the metal particles thereon and produce thereby a continuous metal film upon the surface.

As will be appreciated, by rubbing the metal powder on to the surface of a slightly tenacious adhesive film as above, in contrast to sprinkling it on to a thoroughly sticky film or drawing such sticky film through a receptacle containing a supply of metal powder, as in prior proposals, has the advantage that the metal powder is more sparely and evenly distributed, while the burnishing or flattening-out operation which follows has the effect of spreading the metal particles into a metal film, which, although thin, by reason of the more spare distribution of the metal particles, is nevertheless substantially continuous. Consequently, the method of metallising provided by this invention is more economical than prior methods and at the same time a very uniform and exceedingly thin though complete metal-coating is obtainable by it.

According to a feature of the invention, the operation of subjecting the metal-

coated surface to pressure so as to flatten out the metal particles thereon, is carried out by means of a burnishing roller or rollers.

According to a further feature of the invention, the object to be metallised may be a sheet-material pervious to water and the adhesive used possess water-proof properties, said sheet-material being thereby water-proofed as well as metal-coated by the process.

The invention includes a process of manufacture of waterproof paper by a method of metallising according to this invention as above set forth, wherein the adhesive is a mixture of a hard high-melting-point bitumen with a soft low-melting-point bitumen and these materials are applied to the surface in solution in a volatile solvent (e.g. naphtha or carbon tetra-chloride or white spirit).

Preferably, a resin such for example as a hard oil-soluble phenol-formaldehyde resin, is incorporated with the bitumen in the above solution. The presence of the resin results in a film which is not unduly yielding to the pressure applied in the burnishing operation and which at the same time is not brittle. A hard bitumen tends to be too brittle for the purpose of a metallised paper.

According to another feature of the invention, a further metal may be deposited on the metal film produced upon the surface as above, by any of the well-known chemical or electro-chemical processes for the deposition of metals.

The invention includes metallised surfaces produced as above, and, in particular, a waterproof metallised sheet-material comprising a flexible backing sheet or matrix (for example, paper), a waterproof adhesive (for example, bitumen, with or without a resinous ingredient therewith) permeating the backing sheet and a metal film upon the surface of one or both sides of the backing sheet, which film has been produced by a method of metallising as set forth above and is secured to the backing sheet or matrix by the adhesive, with or without a further metal-coating deposited upon the first.

As will be appreciated, the waterproof metallised sheet-material referred to in the preceding paragraph is not simply a sheet-material having a water-proofing film deposited upon its surface, but is a sheet material impervious to water right through, and therefore, at its edges, which is a distinct advantage. It will also be appreciated that the waterproof properties are conferred upon the material by the character of the adhesive employed for the metallising operation; that is to say, the adhesive employed functions both as a means of attaching the metal-coating to the sheet-material and also as a waterproofing agent.

The invention will now be described in greater detail as applied to the manufacture of lead-coated paper to serve as a substitute for lead-foil. It is to be understood, however, that the invention is not limited to this particular application of it nor to the precise materials and conditions described in the example.

The accompanying drawing illustrates diagrammatically a form of plant for carrying out the process.

The paper is first impregnated with adhesive. For this purpose a web of paper from a supply-reel thereof 1 is fed continuously through an impregnating bath 2 of adhesive of the following composition: 60 parts by weight of soft bitumen (melting point 65° C.—70° C. Dow penetration number at 25° C. 20—30; and ductility at 25° C. greater than 5 cm.); 30 parts by weight of hard bitumen (melting point 110 to 125° C.; Dow penetration number at 25° C. about 5; and ductility at 25° C. nil) and 10 parts by weight of the hard oil-soluble synthetic resin known under the trade name "Albertol", these three ingredients being fused together and dissolved in naphtha. The temperature of the impregnating adhesive solution is preferably slightly above room temperature. The impregnating conditions are so adjusted that the paper is thoroughly impregnated through its substance with the adhesive solution prior to its exit from the impregnating bath, and emerges from the bath with a film of adhesive on each side.

The adhesive-impregnated paper is led from the impregnating bath over a pair of rollers 3, 4 or scrapers which have the effect of controlling the distribution and thickness of the films of excess adhesive adhering to the surfaces of the paper as the latter passes on to a drying chamber 5.

During the passage of the paper through the drying chamber the solvent is completely evaporated from the adhesive carried by the paper. The drying chamber to this end comprises a chamber through which a current of warm air is passed. The temperature of the air is not raised higher than is necessary to produce the desired evaporation of the solvent and preferably should not exceed about 50—60° C. In practice, satisfactory results have been obtained with air at about 30° C. If the temperature of the drying step be much above the temperatures stated, there is a tendency for the final metallised paper product (which travels but slowly through the chamber)

to be undesirably brittle, due, apparently, to the fact that the material of the paper itself is dehydrated in the drying process.

If desired, the bituminising operations may comprise impregnating the paper with a thin solution of bitumen and resin followed by coating the impregnated paper with a surface film of a concentrated solution of bitumen and resin having the composition above stated.

The dried bituminised paper on leaving the drying chamber is cooled and reeled at 6 in readiness for the application of the metal to its surfaces. The cooling operation brings the adhesive film to a non-adhesive condition.

The metal-coating operation will now be described. The bituminised paper from the reel 6 is slowly drawn through a machine which distributes finely divided lead (passing a screen of 200 meshes to the lineal inch) over the surfaces of both sides of the paper simultaneously.

This machine comprises two oppositely travelling endless belts 7, 8 horizontally disposed face to face and in close proximity to one another as shown in the drawing. The web of bituminised paper is fed continuously through the space between the opposite belts 7, 8 in the direction shown by the arrows. The belts sandwich the paper web between them, but, moving in opposite directions and travelling at the same speed, they do not prevent the feeding of the paper web through the space between them. The linear speed of the belts exceeds the speed of the paper feed, so that, as will be appreciated, there is a rubbing action between the belts and the opposed surfaces of the paper as the latter is drawn through the space between the belts.

The travelling belts are enclosed within the chamber 11 and the temperature of the atmosphere within this chamber is maintained at about 60° C. to 70° C. The raised temperature obtaining in the chamber 11 has the effect of softening and rendering slightly tenacious the bitumen films on the paper web as the paper web passes through the space between the belts 7, 8.

The lower belt extends beyond the upper belt at one end 9 as shown and at this end travels towards the interfaces between the belts and the paper web. Situated above the belt 8 at that end at which it extends beyond the belt 7 is a feed hopper 10 containing finely divided lead of the mesh stated. This hopper is adapted to deliver a continuous supply of finely divided lead across the width of the projecting end 9 of the moving belt 8, with the result that the portion 9 of the belt as it moves towards the interface between the belt and the paper becomes covered with a layer of finely divided lead. As the belt moves on after this layer of lead has reached said interface, the lead becomes transferred from the belt to the slightly tenacious film of bitumen upon the surface of the paper web and firmly rubbed thereon and thereby evenly distributed thereover and the paper passes on, with the metal adhering to its surface, over a guide roller 12, and so, out of the machine at 13.

As will be appreciated, the projecting portion 9 of the lower belt constitutes in effect a conveyor for continuously feeding finely divided lead to the interface between the lower belt and the underside of the paper web. In a similar way, at the other end of the machine the paper web itself is made to convey a continuous supply of finely divided lead to the interface between the upper surface of the paper web and the upper belt 7. To this end a second feed hopper 14 is provided, situated above the paper web so as to deliver finely divided lead on to it just prior to its entry into the space between the belts 7, 8. This lead becomes rubbed on to and evenly distributed over the slightly tenacious bitumen film on the upper side of the paper web in the machine; exactly as does the lead which is deposited upon the underside of the web.

Arranged beneath the belts is a collecting tray 15 for collecting finely divided lead which has not become attached to the paper web.

The paper web leaves the chamber 11 at 13 coated on both sides with a layer of lead particles adhering to the surfaces of the paper by means of the films of bitumen thereon. The lead-coated paper passes on to a pair of burnishing rollers 16 which apply pressure to the paper and are adapted to flatten out the metal particles thereon, and convert the film of separate particles into a continuous metal film upon the surface of the paper. It will be appreciated that this burnishing operation takes place on both sides of the paper simultaneously.

If desired, the metallised paper may now be polished, and, for this purpose, after leaving the burnishing rollers, passes on between a pair of buffing wheels 17 which apply a gloss to the metal films on the two sides of the paper.

The metal-coated paper may now be lacquered, and for this purpose passes on to the felted rollers 18, 19 dipping each in a bath of lacquer, and from these rollers the paper with a film of lacquer upon each metallised surface is led through a second drying chamber 20 which dries the lacquer. Finally, the lacquered metal-

lised paper is reeled ready for use.

The burnishing rollers 16 should be accurately cambered and their surfaces should be polished. Moreover, it is preferred that they should be heated, for example with steam. It is found that better results are obtained with heated rollers than with cold rollers. If desired, the bituminised paper may be passed directly from the drying chamber 5 to the metallising chamber 11 instead of first being reeled.

It has been found that satisfactory results are obtainable by burnishing the metal layer into a continuous metal film upon the surface of the paper, by rolling said surface with steel-shot, instead of by passing the metal-covered paper between burnishing rollers as in the example described above.

A second metal coating may be applied to the first coating by electro-deposition, or by immersing the lead covered paper in suitable metal salt solutions, e.g. a solution of copper sulphate in water, if the second metal coating is to be of copper. The second metal-coating may or may not be burnished.

By the present invention metallised sheet-material such as paper may be produced which is both air-proof and water-proof and also possesses the true appearance of metal-foil in contrast to the appearance of paper merely covered with a layer of metal particles such as is characteristic of the surfaces which have been simply coated with metallic paints.

The metallised sheet material which is produced according to this invention can be soldered by the employment of suitable alloys, that is to say, alloys the melting point of which is not sufficiently elevated to damage the paper or other backing when melted on to the sheet.

We are aware of Specification No. 305,515 published subsequently to the date of our Application, and we do not claim anything claimed therein.

We are aware of prior Specification No. 20,542/04 and do not claim anything disclosed therein.

Having now particularly described and ascertained the nature of our said invention, and in what manner the same is to be performed, we declare that what we claim is:—

1. A method of metallising a surface, which comprises applying thereto a film of an adhesive, depositing upon said film a coating of metal powder, rubbing said powder on to the adhesive film whilst the latter is in a slightly tenacious condition and thereby finely distributing it over said film and firmly attaching it thereto, and subjecting the resulting metal-coated surface to pressure, so as to flatten out the metal particles thereon and produce thereby a continuous metal film upon the surface.

2. A method of metallising the surface of a porous material, e.g. porous sheet-material, which comprises applying an adhesive to the material so as to impregnate the latter and form upon its surface to be metallised a thin film of adhesive, depositing upon said film a coating of metal powder, rubbing said powder on to the adhesive film whilst the latter is in a slightly tenacious condition and thereby finely distributing it over the film and firmly attaching it thereto, and subjecting the resulting metal-coated surface to pressure so as to flatten out the metal particles thereon and produce thereby a continuous metal film upon the surface.

3. The method claimed in Claim 1 or Claim 2, wherein the operation of subjecting the metal-coated surface to pressure to flatten out the metal particles thereon and produce thereby a continuous metal film upon the surface, is effected by means of a burnishing roller or rollers.

4. A method of metallising a surface as claimed in Claim 2, wherein the material to be metallised is pervious to water and the adhesive used possesses water-proof properties, the said material being thereby water-proofed as well as metal-coated by the process.

5. A method of metallising a surface as claimed in any of the preceding claims wherein the adhesive comprises bitumen.

6. A method of metallising a surface as claimed in any of the preceding claims 1—4 wherein the adhesive comprises bitumen and a resin, for example, a hard oil-soluble phenol-formaldehyde resin.

7. A process of manufacture of water-proof metal-coated paper which comprises metallising the surface of the paper by a method as claimed in any of the preceding Claims 1—4 and wherein the adhesive is a mixture of a hard high-melting point bitumen with a soft low-melting point bitumen with or without a resin, e.g. a hard oil-soluble phenol-formaldehyde resin.

8. The manufacture of waterproof metal-coated paper by metallising the surface of paper by a method as claimed in any of the preceding claims 1—6, or a process of manufacture of waterproof metal-coated paper as claimed in Claim 7, which comprises passing paper (e.g. in a continuous web) through a bath of adhesive consisting of a water-insoluble adhesive material, preferably bitumen, dissolved in a volatile solvent, so as to impregnate the paper with the adhesive and deposit on its surface a film thereof,

passing the adhesive-impregnated paper through a heated drying chamber to dry off the solvent from the adhesive and metallising the resulting adhesivised paper.

9. A process of manufacture of waterproof metal-coated paper, according to Claim 8, wherein the metal-coated paper, after passing the burnishing rollers, is subjected to a polishing operation, for example by means of buffing-wheels.

10. The subject-matter of any of the preceding claims, wherein the metal applied to the surface is lead.

11. The combination with the subject-matter of any of the preceding claims of the step of applying a second metal-coating upon the surface metallised, by a process of chemical or electro-chemical deposition.

12. Sheet material the surface or surfaces of which have been metallised by a method as claimed in any of the preceding claims 1 to 6, or 10 or 11.

13. Metal-coated and waterproofed paper which has been manufactured by a method of metallising as claimed in any of the preceding claims 1 to 6, or Claims 10 or 11, or which has been produced by a process as claimed in Claims 7, or 8, or 9.

14. Apparatus for distributing finely divided metal over the surfaces of both sides simultaneously of a continuous web of sheet-material carrying an adhesive in a method or process as claimed in any of the preceding claims 1—11, which comprises a pair of oppositely-travelling endless-belts disposed horizontally face-to-face and in close proximity to one another, means to feed a web of sheet-material carrying adhesive continuously through the space between the belts, means to deliver finely divided metal on to the moving web of sheet-material before it enters said space, and means to deliver a similar supply on to the lower belt before the latter reaches the interface between itself and the web of sheet-material, said lower belt being extended beyond the upper belt at one end to receive this supply, and travelling towards said interface at this end, the web and the lower belt thus constituting conveyors for the metal to the interfaces between the belts and the web.

Dated this 13th day of September, 1929.
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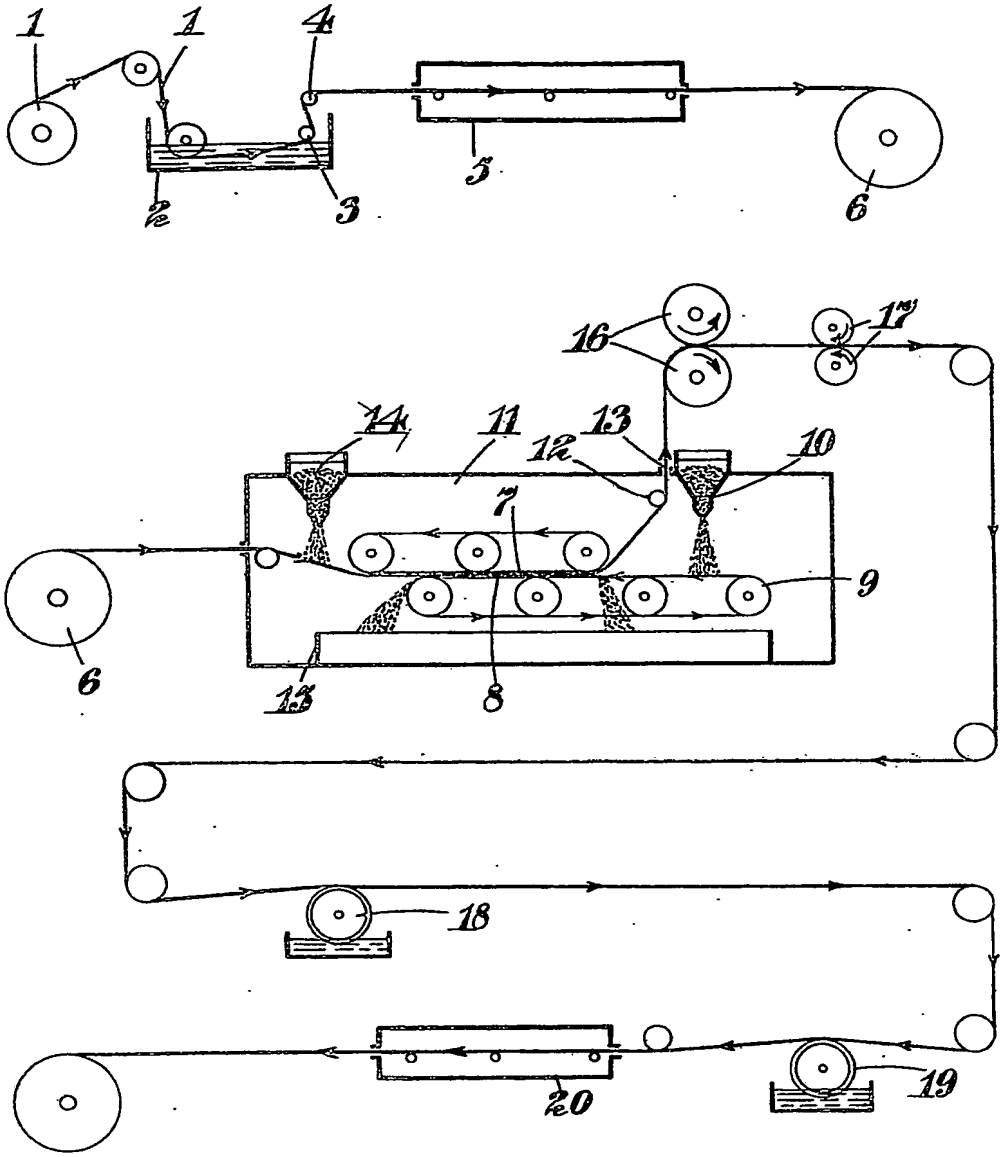

[This Drawing is a reproduction of the Original on a reduced scale.]

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